CHAPTER 6

FIRE PREVENTION AND PROTECTION

6-1. General. The need for fire prevention and protection is generally more critical in polar regions than in temperate climates. Each site must be evaluated in terms of the following parameters when determining the extent of required fire protection facilities.

a. Isolation. Fire hazards must be especially guarded against at isolated sites because the loss of facilities and materials during extreme low temperatures constitutes a major threat to survival. The fire hazard at each site should be evaluated in terms of distance to other facilities, and the availability and reliability of alternate forms of transportation.

b. Climate. Each building should be evaluated in terms of the effects of local winds and temperatures on fire fighting capability and on the survivors of a major fire.

(1) Wind. Strong winds can occur for extended periods, making fires spread rapidly and control difficult.

(2) Cold. The fire itself will burn more rapidly at colder temperatures for two reasons: the weight of a unit volume of air will increase with a decrease in temperature, making more oxygen available to the fire at low temperatures; and the increased thermal gradient between the fire and surrounding air produces an updraft or "fire storm." Wind velocities at the edge of a large fire can reach 100 miles per hour. Cold also hampers fire fighting because of decreased personnel efficiency, and the increased possibility that fire fighting water may be frozen.

6-2. Fire prevention. Information and criteria on noncombustible and fire retardant materials are available in AFM 88-15, TM 5-812-1, the National Fire Codes, the Uniform Building Code, and the National Building Code. Fire ratings for various materials are given in the Underwriters' Building Materials List. These materials can do much to prevent and retard fires and their use should be given special consideration in arctic regions. The use of many of the common noncombustible building materials may become prohibitive in isolated locations, however, because of their weight. Fire retardant materials should be considered to obtain the maximum degree of protection where noncombustible materials cannot be utilized because of economic considerations. Fire retardant materials should be used sparingly, however, since the adverse climate causes these materials to leach and deteriorate at an accelerated rate. Consideration should also be given to materials with fire retardant, intumescent coatings. New noncombustible or fire retardant products should be considered for arctic construction.

6-3. Fire protection. Fire protection facilities should be provided in accordance with AFM 88-15, TM 5-812-1 and the National Fire Codes. Design for water supplies should be based on TM 5-852/AFAR 88-19, Chapter 5. Detailed discussions are presented in each of those references. A short summary Is given below.

a. Water supply lines. Outside water supply lines can be protected from freezing by several possible combinations of heat cables, insulation, circulation, and heat exchangers.

b. Water storage. Underground water sources are often not available in arctic regions. Surface sources are normally usable only during summer months and winter storage is required. Under these conditions, the storage tank must have the capacity to store several months' supply of domestic water, in addition to reserve water for fire fighting. Excessive domestic use can result in partial depletion or consumption of the fire reserve before new supplies are available in the spring. Therefore, the storage tank should be designed to make it difficult to draw water for domestic use from the reserve supply. Water storage tanks exposed to severe cold must be heated and insulated, and the water circulated continuously. The heat source is normally steam or electricity, with cost and availability being the determining selection factors. Heating techniques include circulating tank water through a heat exchanger or flow-through type electric heater. In coastal locations, where heavy ice buildup can be expected, water storage tank design should include special protection for the tank vent. Driving winds have also been known to block a 6-inch vent, and the vacuum then produced as water is drawn can cause the tank to collapse. Protection can be provided by venting the tank in the pumphouse and not having an exterior vent.

c. Fire protection systems. Fire protection systems generally considered where freezing could be a problem are dry fire lines, dry sprinkler systems, sprinkler systems charged with antifreeze solutions, or inert gas systems. The installations should be designed and installed in accordance with the appropriate National

Fire Protection Association standards for fire protection Systems. Special precautions must be taken to prevent back-siphonage if antifreeze solutions are used in sprinkler systems. If inert-gas systems are installed in areas occupied by personnel, special precautions must be taken against suffocation. Under special conditions, dry chemical extinguishers might be practicable. High-expansion foam systems may be used to conserve water or where obstructions such as airplane surfaces would restrict sprinkler effectiveness.

d. Fire detection and alarm systems. Fire detection and alarm systems can be used effectively for early detection and control. Although several types of detection devices are available, the most satisfactory devices in general use are the rate-compensated/fixed-temperature units. These devices should be the type which automatically reset after temperature is reduced. Products-of-combustion detectors are effective if located properly and kept clean; however, they are most expensive and are not easily serviced.